



CONTENTS

PERSPECTIVES *Joseph F. Hoffman, Editor*

Lung Surfactant: A Personal Perspective, *John A. Clements* 1

RESPIRATORY PHYSIOLOGY *Donald Massaro, Section Editor*

O₂-Sensing Mechanisms in Excitable Cells: Role of Plasma Membrane K⁺ Channels, *Gabriel G. Haddad, Chun Jiang* 23

The Pulmonary Lipofibroblast (Lipid Interstitial Cell) and Its Contribution to Alveolar Development, *Stephen E. McGowan, John S. Torday* 43

Emerging Roles for Cysteine Proteases in Human Biology, *Harold A. Chapman, Richard J. Riese, Guo-Ping Shi* 63

Cellular and Molecular Mechanisms of Pulmonary Vascular Remodeling, *K. R. Stenmark, R. P. Mecham* 89

CELL PHYSIOLOGY *Paul De Weer, Section Editor*

Ion Channels in Vascular Endothelium, *Bernd Nilius, Felix Viana, Guy Droogmans* 145

Inward Rectifier Potassium Channels, *C. G. Nichols, A. N. Lopatin* 171

Cytoplasmic ATP-Dependent Regulation of Ion Transporters and Channels: Mechanisms and Messengers, *Donald W. Hilgemann* 193

GASTROINTESTINAL PHYSIOLOGY *David C. Dawson, Section Editor*

Cholecystokinin Cells, *Rodger A. Liddle* 221

Physiology of Isolated Gastric Endocrine Cells, *George Sachs, Ningxin Zeng, Christian Prinz* 243

Enteroglucagon, *J. J. Holst* 257

The G Cell, *Mitsutaka Sawada, Chris J. Dickinson* 273

COMPARATIVE PHYSIOLOGY *George Somero, Section Editor*

Evolution and Regulation of Urea Synthesis and Ureotely in (Batrachoidid) Fishes, *Patrick J. Walsh* 299

The Chloride Cell: Structure and Function in the Gills of Freshwater Fishes, *Steve F. Perry* 325

ENDOCRINE PHYSIOLOGY <i>Jean D. Wilson, Section Editor</i>	
Regulation of Ovarian Follicle Atresia, <i>Antti Kaipia, Aaron J. W. Hsueh</i>	349
Specific, Nongenomic Actions of Steroid Hormones, <i>M. Wehling</i>	365
RENAL AND ELECTROLYTE PHYSIOLOGY <i>Robert J. Alpern, Section Editor</i>	
Biological Functions of Angiotensin and Its Receptors, <i>T. Matsusaka, I. Ichikawa</i>	395
Renal K ⁺ Channels: Structure and Function, <i>Wenhui Wang, Steven C. Hebert, Gerhard Giebisch</i>	413
Regulation of Gene Expression by Hypertonicity, <i>Maurice B. Burg, Eugene D. Kwon, Dietmar Kältz</i>	437
NEUROPHYSIOLOGY <i>Bruce P. Bean, Section Editor</i>	
Chemical Activators of Sensory Neurons, <i>John N. Wood, Reginald Docherty</i>	457
Control of M-Current, <i>Neil V. Marrion</i>	483
CARDIOVASCULAR PHYSIOLOGY <i>Christine Seidman, Section Editor</i>	
Endothelial Cell Regulation of Contractility of the Heart, <i>Saul Winegrad</i>	505
Spatial Relationships in Early Signaling Events of Flow-Mediated Endothelial Mechanotransduction, <i>Peter F. Davies, Kenneth A. Barbee, Natacha DePaola, Abdul I. Barakat, Michael V. Volin, Andre Robotewskyj, Jai Chen, Loren Joseph, Melvin L. Griem, Miles N. Wernick, Elizabeth Jacobs, Denise C. Polacek</i>	527
The Cellular and Molecular Response of Cardiac Myocytes to Mechanical Stress, <i>Junichi Sadoshima, Seigo Izumo</i>	551
SPECIAL TOPIC: MECHANOSENSITIVITY <i>Owen P. Hamill, Special Topic Editor</i>	
Introduction: Molecular Mechanisms of Mechanotransduction, <i>Owen Hamill</i>	573
Tensegrity: The Architectural Basis of Cellular Mechanotransduction, <i>D. E. Ingber</i>	575
Osmoreceptors in the Central Nervous System, <i>Charles W. Bourque, Stéphane H. R. Oliet</i>	601
Induced Membrane Hypo-Hyper-Mechanosensitivity: A Limitation of Patch-Clamp Recording, <i>Owen P. Hamill, Don W. McBride, Jr.</i>	621

CONTENTS (continued) ix

Mechanosensitive Channels of <i>Escherichia coli</i> : The MscL Gene, Protein, and Activities, <i>Sergei I. Sukharev, Paul Blount, Boris Martinac, Ching Kung</i>	633
Molecular Modeling of Mechanotransduction in the Nematode <i>Caenorhabditis elegans</i> , <i>Nektarios Tavernarakis, Monica Driscoll</i>	659
INDEXES	
Subject Index	691
Cumulative Index of Contributing Authors, Volumes 55-59	701
Cumulative Index of Chapter Titles, Volumes 55-59	704



SUBJECT INDEX

A

Acetylcholine
calcium-permeable channels and, 152
ECL cell stimulation and, 248-49
parietal cell acid secretion and, 244
proglucagon-derived peptide secretion and, 261
vasodilatory responses to pulmonary hypertension and, 109
Acid-base regulation in fish
gill chloride cells and, 337-39
Acidic fibroblast growth factor (aFGF)
endothelial cell proliferation in lung development and, 91
Acidosis
fish gill chloride cells and, 338-39
Acrosome reaction
progesterone and, 375
Actin
regulation of ion channels/transporters and, 194
Actin cytoskeleton
physical linkage of integrins to, 586
Actomyosin ATPase activity
modulation of adrenergic effect on, 518-19
Adhesion receptors
as mechanoreceptors, 584
Adipocytes
maturation of
pulmonary lipofibroblast maturation compared, 56-58
Adrenomedullin
calcium-permeable channels and, 152
Airway cilia
cathepsin S and, 82-83
Aldose reductase gene
aberrant regulation in diabetes, 441-42
osmotic regulation and, 439-40
Aldose reductase osmotic response element, 440-41
Aldosterone
membrane-binding sites for, 378-80
specific, nongenomic effects of, 370-74
stimulatory effect of angiotensin on, 401-2
Alkalosis
fish gill chloride cells and, 337-38
Alpha-adrenergic agonists
endothelial cells modulating, 521
Amino acid receptors
excitatory, 460-64
Amino acids
cholecytokinin secretion and, 235
Ammonia
gastrin release and, 289-90
Androgens
adipocyte maturation and, 57
ovarian follicle atresia and, 356
specific, nongenomic effects of, 376-77
Angiotensin, 395-408
kidney ontogeny and, 398-99
pathogenic role in progressive renal disease, 397-98
production and action in heart, 399-401
stimulatory effect on aldosterone, 401-2
Angiotensin II
lung vascular development and, 94-95
pulmonary hypertension and, 110
stretch-induced cardiac hypertrophy and, 562-65
Angiotensinogen
renin-angiotensin system and, 403
Angiotensin receptors
in renal cells, 395-96
Anguilla rostrata
gill chloride cells of, 327
Anion channels
cytoplasmic ATP and, 210
Anion exchange, 203-4
Antigen-presenting cells
cathepsin S expression in, 77
Apoptosis
lung-specific, 6
Apoptosis, 349-59
in ovary, 351-58
regulation of
hormonal mechanisms in, 358-59
Apoptosis-regulating genes, 350-51
Arachidonic acid
adipocyte differentiation and, 57-58
M-current modulation and, 488
renal potassium channels and, 418
Atherosclerosis
focal
causative factors of, 528
Atomic force microscopy (AFM)
endothelial surface geometry and, 532
ATP
calcium-permeable channels and, 152
cytoplasmic anion channels and, 210
calcium channels and, 209-10
epithelial sodium channels and, 211
potassium channels and, 207-9
nonselective cation channels and, 151
polyvalent cation chelation by, 198-99
regulation of ion channels/transporters and, 193-213
ATP-binding proteins
ATP-dependent ion channels/transporters and, 196-98
ATP receptors
on sensory neurons, 465-66
Atrial natriuretic peptides
endothelial cells modulating, 521
Atropine
gastrin release and, 289

B

Bacteria
mechanosensitive channels in roles of, 652-63
Barakat, A. I., 527-46
Barbee, K. A., 527-46
Basic fibroblast growth factor (bFGF)

endothelial cell proliferation in lung development and, 91

B cells cathepsin S expression in, 77

Beta-adrenergic agonists endothelial cells modulating, 521

Betaine in renal medulla, 438 hypertonicity and, 442

Betaine transporter, 442-44

Betaine transporter gene regulation in vivo, 444 transcription of hypertonicity and, 443

Betaine transporter tonicity-responsive enhancer element, 443-44

BHQ intracellular calcium stores and, 154-55

Bleomycin hydrolases, 66-67

Blood-brain barrier urea permeability across, 606

Blood vessels permeability of endothelial ion channels and, 161

Blount, P., 633-53

Body fluid homeostasis osmoreceptors and, 602

Bombesin gastrin release and, 289

Bourque, C. W., 601-15

Bradykinin calcium-permeable channels and, 152 nonselective cation channels and, 151 vasodilatory responses to pulmonary hypertension and, 109

Bradykinin receptors on sensory neurons, 474

Brain cholecystokinin in, 222

Breast cancer membrane fluidity in steroids and, 367

Burg, M. B., 427-52

C

Caenorhabditis elegans body touch avoidance in neuronal circuitry for, 678-81

degenerin gene family of, 681-84

extracellular matrix of proteins affecting, 676-77 mechanosensitive behaviors in, 661 mechanotransducing channel in subunit composition of, 671-73 mechanotransduction in, 659-86 regulation of apoptosis in, 350-51 touch cell development in, 665-66 touch receptor function in structural genes required for, 666-71 touch receptor neurons of, 661-65 touch transduction in intracellular proteins required for, 673-76

Calcineurin capsaicin desensitization and, 471-72

M-current activity and, 499-500

Calcium intracellular M-current modulation and, 489-90 vitamin D₃ and, 377 sodium-hydrogen ion exchange and, 203

Calcium channels cholecystokinin secretion and, 235-36 cytoplasmic ATP and, 209-10 oxygen deprivation and, 30

Calcium-permeable channels endothelial, 152-55

Calcium pumps, 206

Calcium signaling endothelial ion channels and, 159-60

Calcium-sodium ion exchange, 200-3

Calcium uptake in fish gill chloride cells and, 332-34

Calmodulin sodium-hydrogen ion exchange and, 203

Calpains, 65-66 cellular signaling and, 66

Cancer amidated gastrin and, 283

Capsaicin desensitization, 471-72

Capsaicin receptors on sensory neurons, 466-74

Capsazepine capsaicin responses and, 467-68

Carassius auratus calcium uptake in gill chloride cells and, 332

Carbamoyl phosphate synthetase isozyme ureogenesis in teleosts and, 301-2

Cardiac cells sodium-calcium ion exchange in, 200-3

Cardiac contractile proteins regulation of, 516-18

Cardiac contractility endothelial cell regulation of, 505-22

endothelin and, 511-14 nitric oxide and, 514-15

Cardiac hypertrophy angiotensin and, 399-401

Cardiac myocytes responses to mechanical stress, 551-66

Carotid bodies oxygen-sensing mechanisms in, 25-27

Cathepsin K physiological roles of, 73-77

Cathepsins, 67-70

Cathepsin S ciliary function and, 81-83 MHC class II antigen presentation and, 78-81 physiological roles of, 77-83

Cation channels cAMP-gated in sensory neurons, 474 endothelial, 151-52 mechanosensitive osmoreception and, 611-15

Cell adhesion mechanical stress and, 592

Cell-cell adhesion molecules force transfer across cell surface and, 584

Cellular mechanotransduction, 575-96 tensegrity model and, 577-95

Cellular tensile strength, 580-83

Cell volume role in osmoreception, 610

Central nervous system osmoreceptors in, 601-15

Cerebral cortex cholecystokinin mRNA in, 223

cGMP renal potassium channels and, 424

Chapman, H. A., 63-83

Chemical signaling flow-mediated, 545-46

Chen, J., 527-46

C

Chloride cells
See *Fish gill chloride cells*

Chloride channels
endothelial, 156–57

Chloride uptake
in fish
gill chloride cells and, 334–35

Cholecystokinin (CCK)
gastrin release and, 289
gene structure and expression, 223–24
peptide structure of, 222–23
release of, 227–28
regulation of, 228–37
structure–activity relationships of, 224

Cholecystokinin (CCK) receptors, 224–25

Cholecystokinin cells, 221–37
intracellular signaling in, 232

Chromaffin cells
ECL cells and, 247–48

Cilia
airway
cathepsin S and, 82–83

Clements, J. A., 1–18

Clostridium perfringens
mscL homologues in, 650

Coelacanths
ureogenesis in, 302–3

Colchicine
run down of calcium channels and, 210

Collagen
developing pulmonary artery and, 97–98
lung vascular development and, 99
production by pulmonary lipofibroblast, 48–49

Colonic cancer
amidated gastrin and, 283

Compatible organic osmolytes in renal medulla, 438–39

Contractile interstitial cell
relationship to pulmonary lipofibroblast, 53–55

Corticosterone
behavioral effects of, 374

Cortisol
stress response in vertebrates and, 307
transmembrane currents and, 374

Creatine phosphate
potassium-chloride cotransport and, 205

Cyclic ADP-ribose
M-current modulation and, 492–93

Cystatin superfamily
cysteine protease inhibition and, 71

Cysteine proteases, 63–83
classification of, 65–72
inhibitors of, 71–72
physiological roles of, 72–83
regulation of activity of, 70–71
structural and functional features of, 66

Cytocalasin B
run down of calcium channels and, 210
sensitivity of endothelial cells to shear stress and, 158

Cytocalasin D
epithelial sodium channels and, 211

Cytokines
cathepsin S induction by, 77
release by endothelial cells
pulmonary hypertension and, 112–13

Cytoskeleton
ATP-dependent ion channels/transporters and, 199
epithelial sodium channels and, 211
flow signaling and, 543–45

D

Davies, P. F., 527–46

D cells, 251–53

Degenerin gene family
in *Caenorhabditis elegans*, 681–84

Degenerins
mechanotransduction and, 685–86

Dendritic cells
cathepsin S expression in, 77

DePaola, N., 527–46

Desmin
in pulmonary lipofibroblast, 48

Diabetes
aberrant aldose reductase gene regulation in, 441–42

Diacylglycerol
effects of aldosterone and, 370

Dibutyryl cAMP
gastrin release and, 289

Dickinson, C. J., 273–92

Diltiazem
cholecystokinin secretion and, 233

Dipalmitoylphosphatidylcholine in lung surfactant, 6–10

Docherty, R., 457–75

Dopamine
carotid sinus discharge during hypoxia and, 27

Dorsal root ganglia (DRG)
non-NMDA ion channel in, 461–63

Driscoll, M., 659–86

Droogmans, G., 145–62

Duodenal ulcer disease
Helicobacter pylori and, 290–92

Duodenum
cholecystokinin mRNA in, 223

E

ECL cells, 245–51
gastric acid secretion and, 246
growth of, 250–51
histamine production in, 250
inhibition of, 249–50
as members of chromaffin cell family, 247–48
stimulation of, 248–49

eIF-4E
protein synthesis and, 556–57

Elasmobranchs
urogenesis in, 302–3

Elastases
vascular
pulmonary hypertension and, 121–22

Elastin
degradation of
vascular inflammation and, 75–76
production by pulmonary lipofibroblast, 48–49

Electrolyte transport
aldosterone and, 370

Emphysema
elastolytic cathepsins and, 76–77

Endocrine cells
gastric, 243–53

Endoplasmic reticulum
gastrin biosynthesis and, 275

Endosomes
targeting of enzymes to cysteine proteases and, 70–71

Endothelial cells
cardiac contractility and, 505–22
changes in
development of pulmonary hypertension and, 107–8
electrogenesis in, 146–48
integrated function of, 519–22

luminal
imaging of, 531–35
replication in lung development, 91–92

Endothelial cytoskeleton
flow signaling and, 543–45

Endothelial-derived relaxing factor/nitric oxide (EDRF/NO)
production of
pulmonary hypertension and, 108–9

Endothelial flow signaling, 527–46

Endothelial surface adhesion sites
ab luminal
biochemical signaling at, 540–41
imaging of, 538–41

Endothelin
action of, 511–14
lung vascular development and, 94, 96

Endothelin-1
nonselective cation channels and, 151
pulmonary hypertension and, 110
secretion of
mechanical stretch and, 565

Endothelium
production and release of
vasoactive mediators by
pulmonary hypertension and, 108–14
vascular
ion channels in, 145–62

Endothelium-derived
down-regulating cardioactive substances, 515–16

Enteroglucagon, 257–67

Epinephrine
ECL cell stimulation and, 248–49

Erwinia carotovora
mscL homologues in, 650

Escherichia coli
mechanosensitive channels of, 633–53
activities of, 638–43
cloning of *mscL* and, 643–45

MscL protein of, 645–48
patch clamping, 635–38

Estradiol
membrane fluidity and, 367–68

Estrogens
membrane-binding sites for, 381
ovarian follicle growth and, 355
specific, nongenomic effects of, 376

Extracellular fluid (ECF)

osmotic pressure of, 601

Extracellular matrix (ECM)
accumulation of
angiotensin II and, 397
of *Caenorhabditis elegans*
proteins affecting, 676–77
changes during lung development, 96–100

F

Fas antigen
apoptosis and, 351

Fetal lung
lung surfactant in, 9–10

Fibroblast growth factor (FGF)
endothelial cell proliferation in lung development and, 91

Fibroblasts
adventitial
changes in pulmonary hypertension, 124–29

Fibronectin
lung vascular development and, 98–99

Fish
urea excretion in, 299–319
site and mechanisms of, 311–17

Fish gill chloride cells, 325–43
acid-base regulation and, 337–39
gas transfer and, 339–42
ionic regulation and, 332–37
structure of, 326–32
subtypes of, 330–32

Fludrocortisone
specific, nongenomic effects of, 370–71

Food ingestion
cholecystokinin release and, 227

Forskolin
cholecystokinin release and, 231

G

Gadolinium
cationic mechanosensitive channels and, 614

Gallbladder
cholecystokinin receptors in, 224

Gap junction channels
endothelial, 158–59

Gastric acid secretion
endocrine regulation of, 253
peripheral regulation of
histamine and ECL cells and, 246

Gastric cancer
amidated gastrin and, 283

Gastric endocrine cells, 243–53

Gastric inhibitory polypeptide
gastrin release and, 289

Gastric motility
oxyntomodulin and, 262

Gastrin
ECL cell stimulation and, 248–49
parietal cell acid secretion and, 244
peptic ulcer disease and, 287–92
posttranslational processing of, 274–80

Gastrin receptors, 280–82

Gastrin-releasing peptide (GRP)
cholecystokinin release and, 231
secretion of, 288

G cell, 253, 273–92

Gene expression
osmeregulation of, 427–52
intracellular salt concentration and, 448–50

Giant cell arteritis
elastin degradation and, 76

Glicentin
actions of, 261–62

Glomerulosclerosis
role of angiotensin in, 397–98

GLP-1
actions of, 262–66

GLP-2, 266

Glucagon
gastrin release and, 289
secretion of
GLP-1 and, 264

Glucocorticoids
adipocyte maturation and, 57
membrane-binding sites for, 380
specific, nongenomic effects of, 374–75

Glucos transporters, 205–6

Glutamate
ligand-gated sensory neuron ion channels and, 460

Glutamate receptor ion channels
responses to polyamines, 182–83

Glutaminase, 308–10

Glutathione
potassium channels in
pulmonary arterial smooth muscles and, 30

Glyceraldehyde-3-phosphate dehydrogenase
glucose transporters and, 206

Glycerophosphocholine
in renal medulla, 438

Golgi stack

gastrin biosynthesis and, 275-78

Gonadal steroids
membrane-binding sites for, 380-81
specific, nongenomic effects of, 375-77

Gonadotropin-releasing hormone (GnRH)
release of
pregnanolone and, 368

Gonadotropins
ovarian follicle atresia and, 353-54

G proteins
M-current modulation and, 490-91
sodium-hydrogen ion exchange and, 203

Griem, M. L., 527-46

Growth factors
mechanical stress and, 561-66

Growth hormone (GH)
ovarian follicle growth and, 354

GRPP
actions of, 261-62

Gulf toadfish
urea excretion in, 317-19
ureogenesis in, 304
regulation of, 305-11

Gut peptides
proglucagon-derived, 257-60

H

Haddad, G. G., 23-39

Haemophilus influenzae
mscL homologues in, 650

Hamill, O. P., 621-29

Hamill, W., 573-74

Heart
mechanosensors of, 557-61
organ remodeling processes in
gene polymorphisms in
renin-angiotensin system and, 406-8
production and action of
angiotensin in, 399-401
See also Cardiac contractility

Heat shock proteins
hypertonicity and, 447
organic osmolytes and, 447-48

Helicobacter pylori
ulcers and, 290-92

Hepatic lipocyte
pulmonary lipofibroblast compared, 55-56

Hilgemann, D. W., 193-213

Histamine
calcium-permeable channels and, 152
gastric acid secretion and, 246
nonselective cation channels and, 151
parietal cell acid secretion and, 244
production in ECL cells, 250

Histamine-3
ECL cell inhibition and, 249-50

Holst, J. J., 257-67

Hsueh, A. J. W., 349-59

Hydrogen-sodium ion exchange, 203

5-Hydroxytryptamine
lung vascular development and, 94

Hypergastrinemia
colonic and gastric tumors and, 283

Hypertension
See Pulmonary hypertension

Hypertonicity, 427-52
betaine transport and, 442
betaine transporter gene
transcription and, 443

cell adaptation to
compatible organic
osmolytes and, 438-39

gene expression and, 429-50

heat shock proteins and, 447

inositol transport and, 445-46

inositol transporter gene
transcription and, 446

taurine transport and, 444-45

taurine transporter gene
transcription and, 445

Hypothalamo-neurohypophysial system
organization of, 604-5

Hypoxia
chronic
development of pulmonary hypertension and, 117-18

endothelial cell membrane properties and, 107-8

glucose uptake and, 205

pulmonary vascular smooth muscles and, 28-30

responses to
carotid bodies and, 25-27

I

Ichikawa, I., 395-408

Ictalurus nebulosus
gill chloride cells of, 327

Inflammation
cathepsin K upregulation and, 73

calcium-permeable channels and, 152

gastric acid secretion and, 246

nonselective cation channels and, 151

parietal cell acid secretion and, 244

production in ECL cells, 250

Insger, D. E., 575-96

Inositol
in renal medulla, 438
hypertonicity and, 445-46

Inositol transporter, 445-47

Inositol transporter gene
regulation in vivo, 446-47

transcription of
hypertonicity and, 446

Insulin-like growth factor-I (IGF-I)
folliculogenesis and, 354

Insulin
secretion of
GLP-1 and, 263

Integrins
force transfer across cell surface and, 584
physical linkage to actin cytoskeleton, 586
stretch-induced cellular responses and, 559-60

Interference reflection microscopy (IRM)
abluminal endothelial surface adhesion site imaging and, 538

Interferon- γ
cathepsin S induction by, 77

Interleukin-1 β
cathepsin S induction by, 77
ovarian function and, 354-55

Interleukin-1 β converting enzyme (ICE)
apoptosis and, 351

Interleukin-1 β converting enzyme (ICE) superfamily, 65

Interleukin-6 (IL-6)
ovarian follicle atresia and, 356

Intervening peptide-2 (IP-2), 266

Intestine
cholecystokinin in, 222

Ion channels
cardiac
mechanical stress and, 557-59
cholecystokinin secretion and, 234-37
cotransporters and, 204-6
endothelial, 145-62
functional role of, 159-62
gating of, 177-81
ligand-gated
of sensory neurons, 458-60
regulation of
cytoplasmic ATP-dependent, 193-213

small molecules modulating, 38

vanilloid-gated
pharmacology of, 470-71
properties of, 469-70

protons as activators of, 472-74
See also specific type

Ion exchangers, 200-4

Ion pumps, 206

Ion transporters
regulation of
cytoplasmic ATP-dependent, 193-213

Ischemia
glucose uptake and, 205

Isobutylmethylxanthine
gastrin release and, 289

Isoprenol
cholecystokinin secretion and, 233

Izumo, S., 551-66

J

Jacobs, E., 527-46

Jiang, C., 23-39

Joseph, L., 527-46

K

Kainate receptors
non-NMDA, 460-63

Kaipa, A., 349-59

Kidney
angiotensin receptors in, 395-96
organ remodeling processes in
gene polymorphisms in
renin-angiotensin system
and, 406-8
potassium channels in, 413-31
Kidney disease
pathogenic role of angiotensin
in, 397-98

Kidney ontogeny
angiotensin and, 398-99

Kültz, D., 427-52

Kung, C., 633-53

Kwon, E. D., 427-52

L

Lake Magadi tilapia
urea excretion in, 312
ureogenesis in, 303

Laminin
lung vascular development and, 99

Law of Laplace, 2

L-cell, 257

Leukotrienes
lung vascular development and, 94

Leupeptin
ovalbumin and tetanus toxin
processing and, 81

Liddle, R. A., 221-37

Limb-girdle dystrophy
calpain mutations and, 66

Lipid interstitial cell
See Pulmonary lipofibroblast

Lipid kinases
ATP-dependent ion
channels/transporters and, 196

Lopatin, A. N., 171-84

Lumenal
cholecystokinin-releasing
factor (LCRF)
cholecystokinin release and, 230

Lung development, 43-59
contractile protein expression
in, 100-1
endothelial cell replication in,
91-92
extracellular matrix changes
during, 96-100
morphology of, 44-45
smooth muscle cell replication
during, 92-96
vasculogenesis in, 91-92

Lung fibroblast phenotype
classification by Thy-1 antigen,
45-46

Lung surfactant, 1-18
development of science of, 5-11
discovery of, 1-5
future of research on, 17-18
synthesis of
pulmonary lipofibroblast
and, 49-52

Lymphangiomyomatosis
elastin degradation and, 76

Lymph nodes
cathepsin S expression in, 77

Lysosomes
targeting of enzymes to
cysteine proteases and,
70-71

M

Macrophages
cathepsin S expression in, 77

Magnocellular neurosecretory
cells (MNCs)
electrical activity in
plasma osmolality and, 605

hypothalamic
intrinsic osmosensitivity of,
606-7

location of, 604-5

Mammalian cells
gene activity in
osmoregulation of, 450-52

MAP kinases
cardiac hypertrophy and,
555-56

Marrion, N. V., 483-501

Martinae, B., 633-53

Matsuoka, T., 395-408

McBride, D. W., Jr., 621-29

McGowan, S. E., 43-59

M-current, 483-501
modulation of
receptor-mediated, 485-96
regulation of amplitude of,
496-501

Mecham, R. P., 89-132

Mechanical stress
development of pulmonary
hypertension and, 117-18
growth factors and, 561-66
response of cardiac myocytes
to, 551-66

Mechanochemical transduction
mechanisms for, 588-91

Mechanoreceptors
adhesion receptors as, 584

Mechanosensitive channels,
633-53
activities of, 638-43
endothelial, 157-58
roles in bacteria, 652-63

Mechanosensitivity
mechanisms of, 627-29

Mechanosensors
cardiac, 557-61

Mechanotransduction, 659-86
cellular
architectural basis of, 575-96
degenerating, 685-86
molecular mechanisms of,
573-74

Meissner cells
neurons associated with, 458

Membrane conductance
isotonic volume changes and,
610-11

Membrane hypo-hyper-
mechanosensitivity
patch-clamp recording and,
621-29

Merkel cells
neurons associated with, 458

Mesenchymal cells
relationship of pulmonary
lipofibroblast to, 53-58

Metabolic alkalosis
fish gill chloride cells and,
337-38

Metabolic stress
glucose uptake and, 205

MHC class II antigen presentation
 cathepsin S and, 78–81

Microtubule polymerization
 tension in surrounding actin
 cytoskeleton and, 591

Mineralocorticoids
 membrane-binding sites for,
 378–80

specific, nongenomic effects of,
 370–74

Mitogens
 release by endothelial cells
 pulmonary hypertension and,
 112–13

Mouse mammary tumor virus long
 terminal repeat (MMTV
 LTR)
 rate of transcription of
 steroids and, 366

Muscarine
 M-channel activity and, 494–
 96

N

NADH
 potassium channels in
 pulmonary arterial smooth
 muscles and, 30

NADPH oxidase
 diphenyliodonium-sensitive
 pulmonary vasmotor
 smooth muscle cells and,
 30

NEKTON, 533

Neuro-epithelial bodies (NEB)
 oxygen-sensing mechanisms in,
 28

Neurohypophysial hormones
 osmoregulation and, 604
 release of
 osmoreceptors for, 605–7

Neurons
 osmosensitive, 603–4
 oxygen deprivation and, 37–38
 plasma membranes of
 responses to molecular
 oxygen in, 32–33
 See also Sensory neurons

Neurosteroids
 specific, nongenomic effects of,
 368–69

Neurotoxins
 gastrin release and, 289

Nichols, C. G., 171–84

Nicotinic receptors
 on sensory neurons, 458–60,
 464–65

Nilius, B., 145–62

Nitric oxide

cardiac contractility and,
 514–15

flow-sensitive signaling
 pathways for, 541–43

renal potassium channels and,
 424

NMDA receptors
 on sensory neurons, 463–64

Nocadazole
 eNOS expression and, 542

O

Oliet, S. H. R., 601–15

Oligocottus maculosus
 urea excretion in, 312

Omepazole
 ECL cell hyperplasia and,
 250–51

Oncorhynchus mykiss
 gill chloride cells of, 327

Oocytes
 maturation of
 progesterone and, 375

Opioids
 M-current and, 497

Oreochromis mossambicus
 gill chloride cells of, 327–28

Organic osmolytes
 accumulation of
 regulation of genes for, 450
 heat shock proteins and, 447–48
 See also Compatible organic
 osmolytes

Organum vasculosum lamina
 terminalis (OVLT)
 functional anatomy of, 608
 osmoreceptors in, 605–6

Osmoreception
 cellular basis for, 608–11
 channels underlying, 611–15

Osmoreceptors
 body fluid homeostasis and, 602
 in central nervous system,
 601–15
 discovery of, 602–3
 functional anatomy of, 607–8
 location of, 603–4
 for neurohypophysial hormone
 release, 605–7
 in organum vasculosum lamina
 terminalis, 605–6

Osmoregulation
 neurohypophysial hormones
 and, 604

Osteoclasts
 cathepsin K expression in, 73

Ovarian follicle atresia
 regulation of, 349–59

Ovaries

cathepsin K expression in, 73

Ovary
 apoptotic cell death in, 351–58

Oxygen
 potassium-channel modulation
 and, 33–35

Oxygen deprivation
 neuronal response to, 37–38

Oxygen sensing
 mechanisms in excitable cells,
 23–39

Oxygen tension
 coronary venous perfusate and,
 509–11

Oxymodulin
 actions of, 262

Oxytocin
 synthesis of, 604

P

Pacinian corpuscles
 neurons associated with, 458

Pancreas
 cholecystokin receptors in,
 224–25

GLP-1 and, 262–64

Pancreatic juice
 cholecystokinin-releasing factor
 in, 230–31

Pancreozymin, 221

Papain superfamily, 65–70

Paramecium
 mechanosensitive conductances
 in, 651

Parietal cells
 acid secretion by
 regulation of, 243–44

Patch clamping
 Escherichia coli and, 635–38

Patch-clamp recording
 induced membrane hypo-hyper-
 mechanosensitivity and,
 621–29

mechanical requirements of,
 622–27

Peptic ulcer disease
 gastrin and, 287–92

Perlecan
 lung vascular development and,
 99–100

Perry, S. F., 325–43

pH
 cysteine proteases and, 70

endothelial ion channels and,
 162

Phalloidin
 run down of calcium channels
 and, 210

L-Phenylalanine

cholecystokinin release and, 231

Phorbol esters
M-current modulation and, 487-88

β -Phorbol-12-myristate-13-acetate
cholecystokinin release and, 231

Phosphatase 2B
M-current activity and, 499

Phosphatidylglycerol
in lung surfactant, 6-8

Phosphatidylinositol bisphosphate
regulation of ion channels/transporters and, 194

Phosphoinositide hydrolysis
effects of aldosterone and, 370

Phospholipases
mechanical stretch of cardiac myocytes and, 554-55

Pituitary adenylate cyclase-activating peptide (PACAP)
ECL cell stimulation and, 248-49

Plasma membranes
neuronal responses to molecular oxygen in, 32-33

Plasma osmolarity
magnocellular neurosecretory cells and, 605

Platelet-activating factor (PAF)
vasodilatory responses to pulmonary hypertension and, 109

Platelet-derived endothelial cell growth factor (PD-ECGF)
endothelial cell proliferation in lung development and, 91

Polacek, D. C., 527-46

Polyamines
glutamate receptor ion channels and, 182-83
inward rectifier potassium channels and, 178-81

Potassium
zona glomerulosa response to sodium depletion and, 402

Potassium channels, 23-39
cholecystokinin secretion and, 234-35
cytoplasmic ATP and, 207-9
endothelial, 148-51
flow-sensitive, 535-38
inward rectifier, 171-84
double-pored, 176
Kir1 subfamily of, 173
Kir2 subfamily of, 173

Kir3 subfamily of, 173-75

Kir4 subfamily of, 175

Kir5 subfamily of, 175

Kir6 subfamily of, 175-76
mechanisms of, 177-81
physiology of, 171-72
structural model of, 181-83

modulation of molecular oxygen and, 33-35

oxygen deprivation and, 30-38

oxygen transduction by carotid bodies and, 25-27

in pulmonary arteries
hypoxia-induced inhibition of, 28-30

renal, 413-31

in apical membrane, 419-23

in basolateral membrane, 423-25

molecular structure of, 425-31

in proximal tubule, 413-16

in thick ascending limb, 416-19

transmembrane domain, 172-77

Potassium-chloride cotransport, 205

Pregnenolone
membrane-binding sites for, 381
release of
gonadotropin-releasing hormone and, 368

Prinz, C., 243-53

Progastrin processing products
physiologic relevance of, 283-86

Progesterone
membrane-binding sites for, 380-81
membrane fluidity and, 367-68
ovarian follicle growth and, 355
specific, nongenomic effects of, 375-76

Proglucagon-derived peptides (PGDPs), 257-60
actions of, 261-66
measurement of, 260-61
secretion of, 261

Prostacyclin
production of
pulmonary hypertension and, 108

Prostaglandin E2
gastrin release and, 289

Prostaglandins
adipocyte differentiation and, 57-58
endothelial cells modulating, 521

Proteases

vascular
pulmonary hypertension and, 121-22

Protein kinase A
renal potassium channels and, 418-19, 425

Protein kinase C
activation of
suppression of M-current and, 487-88

renal potassium channels and, 419, 424-25

Protein kinases
ATP-dependent ion channels/transporters and, 196

ion channels and, 207-8

sodium-hydrogen ion exchange and, 203

Protein synthesis
mechanical stretch and, 556-57

Proteoglycans
endothelial cell production of
pulmonary hypertension and, 113

Pseudohypoaldosteronism, 385

Pseudomonas fluorescens
mscL homologues in, 650

Pulmonary artery
developing
collagen and, 97-98

Pulmonary hypertension
adventitial fibroblast changes in, 124-29

development of
changes in smooth muscle cell phenotype during, 114-24

endothelial changes during, 107-8

production and release of
vasoactive mediators by endothelium in, 108-14

vascular remodeling in
cellular mechanisms of, 129-32

Pulmonary lipofibroblast, 43-59
biochemical characterization of, 48-49
classification by Thy-1 antigen, 45-46
gene expression by
effects of retinoic acid on, 53

hepatic lipocyte compared, 55-56

maturation of
adipocyte maturation compared, 56-58

morphologic characterization of, 46-48

relationship to contractile interstitial cell, 53–55

retinoid storage and metabolism and, 52–53

surfactant synthesis and, 49–52

P

Pulmonary surfactant

- See Lung surfactant

Pulmonary vascular remodeling, 89–132

Pulmonary vascular smooth muscle

- effect of hypoxia on, 28–30

Pulmonary vasculature

- development of, 91–105

Pycnodynatosis

- cathepsin K deficiency and, 75

PYY

- ECL cell inhibition and, 249–50

R

Rainbow trout

- gill chloride cells of, 327–28

Red blood cells

- potassium-chloride cotransport activity of, 205

Redox potential

- cysteine proteases and, 70

Renal disease

- pathogenic role of angiotensin in, 397–98

Renal medulla

- compatible organic osmolytes in, 438–39

Renin-angiotensin system (RAS)

- gene polymorphisms in
- organ remodeling and, 406–8
- rate-limiting factors for, 403

Resiniferatoxin (RTX)

- binding to dorsal root ganglia membranes, 468–69

Respiratory acidosis

- fish gill chloride cells and, 338–39

Respiratory distress syndrome

- lung surfactant and, 5
- prevention of, 9–11

Respiratory gas transfer in fish

- gill chloride cells and, 340–42

Retinoic acid

- cathepsin K and, 73
- gene expression by cultured lipofibroblasts and, 53

Retinoids

- storage and metabolism of
- pulmonary lipofibroblast and, 52–53

Riese, R. J., 63–83

Robotewskyj, A., 527–46

S

Saccharomyces cerevisiae

- mechanosensitive conductances in, 650

Sachs, G., 243–53

Sadoshima, J., 551–66

Salt

- intracellular concentration of
- osmoregulation of gene expression and, 448–50

Sawada, M., 273–92

Schizosaccharomyces pombe

- mechanosensitive conductances in, 651

Secretin

- gastrin release and, 289

Secretory granule

- gastrin biosynthesis and, 278–80

Sensory neurons

- ATP receptors on, 465–66
- bradykinin receptors on, 474
- cAMP-gated cation channels in, 474
- capsaicin receptors on, 466–74
- chemical activators of, 457–75
- ligand-gated ion channels of, 458–60
- nicotinic receptors on, 458–60, 464–65
- NMDA receptors on, 463–64
- non-NMDA kainate receptors on, 460–63
- sensitivity of
- regulation of, 475
- serotonin receptors on, 466

Serotonin

- endothelial cells modulating, 521
- nonselective cation channels and, 151

Serotonin receptors

- on sensory neurons, 466

Serpin family

- cysteine protease inhibition and, 71–72

Shear stress

- endothelial cell surface and, 531–35
- endothelial hyperpolarization and, 537
- synthesis and secretion of
- endothelin and, 511

Shi, G.-P., 63–83

Signal transduction pathways activated by mechanical stretch, 552–57

Small intestine

- serotonin-containing enterochromaffin cells in, 247

Smokers' lung

- elastolytic cathepsins and, 76

Smooth muscle

- pulmonary vascular
- effect of hypoxia on, 28–30
- α -Smooth muscle actin in pulmonary lipofibroblast, 48–49

Smooth muscle cells (SMCs)

- changes in phenotype during development of pulmonary hypertension, 114–24
- growth suppression in, 101–2
- replication during lung development, 92–96
- responses to injury, 89–90
- in vascular wall
- heterogeneity of, 103–5

Smooth muscle elasticogenic factor (SMEF), 121

Sodium-calcium ion exchange, 200–3

Sodium channels

- endothelial
- cytoplasmic ATP and, 211
- oxygen deprivation and, 30–31

Sodium depletion

- zona glomerulosa response to potassium and, 402

Sodium-hydrogen ion exchange, 203

Sodium-potassium-chloride cotransport, 204–5

Sodium-potassium pump, 206

Sodium uptake

- in fish
- gill chloride cells and, 335–37

Somatostatin

- cholecystokinin gene expression and, 224
- ECL cell inhibition and, 249–50
- gastrin release and, 289
- M-current and, 497

Sorbitol

- in renal medulla, 438
- hypertonicity and, 439

Spermatozoa

- membrane fluidity in
- steroids and, 367–68

Spleen

- cathepsin S expression in, 77

Squamous cell carcinoma antigen (SSCA), 72

Staphylococcus aureus

- mscL* homologues in, 650

Stenmark, K. R., 89–132

Steroids
 membrane-binding sites for, 378–82
 nongenomic effects of, 365–86
 classification of, 366–67
 specific and nonspecific, 367–68
 rapid action of
 model for, 382–84
 significance of, 384–86

Stomach
 serotonin-containing
 enterochromaffin cells in, 247

Streptococcus faecalis
 mechanosensitive conductances in, 650

Substance P
 calcium-permeable channels and, 152
 endothelial cells modulating, 521
 lung vascular development and, 94
 nonselective cation channels and, 151

Sukharev, S. I., 633–53

Supraoptic nucleus
 functional anatomy of, 607–8

Surface tension
 lung mechanics and, 2–3

Surfactant
 See Lung surfactant

T

Tandem scanning confocal microscopy (TSCM)
 abluminal endothelial surface adhesion site imaging and, 538

Taurine
 in renal medulla, 438

Taurine transporter, 444–45

Taurine transporter gene transcription of
 hypertonicity and, 445

Tavernarakis, N., 659–86

Taxol
 run down of calcium channels and, 210

Teleosts
 urea excretion in, 312
 ureogenesis in, 310–15

Tensegrity model
 cellular mechanotransduction and, 577–95

Teratozoospermia
 progesterone and, 375

Testosterone
 membrane fluidity and, 368

Tetraethylammonium (TEA)
 nerve discharge with hypoxia and, 27

Tetrodotoxin
 gastrin release and, 289

Thapsigargin
 intracellular calcium stores and, 154–55

Thrombin
 nonselective cation channels and, 151

Thromboxane
 production of
 pulmonary hypertension and, 108

Thromboxane A₂
 lung vascular development and, 94

Thy-1 antigen
 pulmonary lipofibroblast classification by, 45–46

Torday, J. S., 43–59

Touch receptor neurons of *Caenorhabditis elegans*, 661–65
 model for
 mechanotransduction in, 678

trans-Golgi network (TGN)
 gastrin biosynthesis and, 277–78

Triiodothyronine
 membrane-binding sites for, 382
 specific, nongenomic effects of, 378

Trypsin-sensitive releasing factor
 cholecystokinin release and, 228

Tubulin
 sensitivity to tensegrity-based thermodynamic alterations, 592

Tumor necrosis factor- α (TNF- α)
 ovarian follicle atresia and, 356

Tyrosine kinases
 M-current modulation and, 491–92
 tyrosine phosphorylation in cardiac myocytes and, 560–61

U

Urea
 excretion in fish, 299–319
 site and mechanisms of, 311–17
 permeability across blood-brain barrier, 606

Ureogenesis
 in teleosts, 310–5

Uromyces appendiculatus
 mechanosensitive conductances in, 651

V

Vaginal epithelial cells
 membrane fluidity in steroids and, 367

Vanilloid receptors, 466–74
 identification of, 465–68
 subtypes of, 468–69

Vascular endothelial growth factor (VEGF)
 lung vascular development and, 91–92

Vascular endothelium
 ion channels in, 145–62

Vascular inflammation
 elastin degradation and, 75–76

Vascular permeability factor, 91

Vasculogenesis
 in lung development, 91–92

Vasculotropin, 91

Vasopressin
 endothelial cells modulating, 521
 secretion of
 osmoreceptors regulating, 602–3
 synthesis of, 604

Vertebrates
 stress response in cortisol and, 307

Viana, F., 145–62

Vimentin
 in pulmonary lipofibroblast, 48

Vinculin
 mechanical signaling cascade and, 586

Vitamin D₃
 membrane-binding sites for, 382
 specific, nongenomic effects of, 377–78

Volin, M. V., 527–46

W

Walsh, P. J., 299–319

Wehling, M., 365–86

Wernick, M. N., 527–46

Winegrad, S., 505–22

Wood, J. N., 457–75

Wound healing
 bradykinin and, 474

Z

Zeng, N., 243–53

